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10/647,586	08/25/2003	Michael Seltzer	M61.12-0550	2416

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<table>
<tr><td rowspan="2">Office Action Summary</td><td>Application No.
10/647,586</td><td>Applicant(s)
SELTZER ET AL.</td></tr>
<tr><td>Examiner
Paras Shah</td><td>Art Unit
2626</td></tr>
</table>

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2007.*

2a)☐ This action is **FINAL.**   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-13,15-17,20,21 and 23-25* is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-13,15-17,20,21 and 23-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a)☐ All   b)☐ Some * c)☐ None of:

   1.☐ Certified copies of the priority documents have been received.

   2.☐ Certified copies of the priority documents have been received in Application No. _____.

   3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

DETAILED ACTION

1.   This Office Action is in response to the RCE filed on 10/18/2007. Claims 1-3, 5-

13, 15-17, 20, 21, and 23-25 remain pending. The Applicants' amendment and remarks

have been carefully considered, but they are are moot in view of new grounds for

rejection.

2.   All previous objections and rejections directed to the Applicant's disclosure and

claims not discussed in this Office Action have been withdrawn by the Examiner.

Response to Arguments

3.   Applicant's arguments (pages 7-11) filed on 10/18/2007 with regard to claims 1-3,

5-13, 15-17, 20, 21, and 23-25 have been fully considered but they are moot in view of

new grounds for rejection.

Response to Amendment

4.   Applicants' amendments filed on 10/18/2007 have been fully considered. The

newly amended limitations in claims 1 and 13 are moot in view of new grounds of

rejection. Specifically, the limitations, "energy of the harmonic component without the

random component" as recited in claim 1 and the limitation "scaling value for the

harmonic component is different than the scaling value for the random component" as

recited in claim 13. A newly cited reference was applied to teach the latter limitation for

claim 13, Rao Gadde *et al.* (US 7,120,580).

Claim Rejections - 35 USC § 112

6.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7.   Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear as to how the scaling parameter for the random component is determined as recited in lines 11-12 of claim 1 (a scaling parameter). Specifically, the determination of the scaling parameter for the harmonic component is shown (see claim 1, lines 5-8), but not for the random component. Referring to the Applicant's specification, the random component is selected with no reasons (see page 17, lines 17-25, α_r is set to fixed value of 0.1). Further, from the claim it is unclear sa to whether the scaling parameter was intended to be derived from the scaling parameter as found for the harmonic component. Hence, for the purposes of compact prosecution the scaling parameter was determined to be different and chosen by any method.

8.   Claims 2, 3, and 5-12 are rejected as being dependent upon a rejected base claim.

Claim Rejections - 35 USC § 103

9.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10.   Claims 1-3, 5, 6, 11, 12, 15, 16, 20, 21, 23, and 24 are rejected under 35 U.S.C.

103(a) as being unpatentable over by Laroche *et al.* ("HNM: A Simple Efficient

Harmonic and Noise Model for Speech" 1993) in view of Rao Gadde *et al.* (US

7,120,580) in view of Gao (US 2002/0035470) .

As to claims 1 and 13, Laroche *et al.* teaches a method of identifying an estimate

for a noise reduced value representing a noise-reduced speech signal, the method

comprising:

decomposing a portion of a noisy speech signal (see page 1, left column,

sect. 1, line 2-3) into a harmonic component (see page 1, left column, sect. 1,

line 2) and a random component (see page 1, left column, sect. 1, line 2-3) (e.g.

It should be noted that noise contained in speech is non-periodic and is random);

summing the harmonic component and the random component to form the

noise-reduced value (see page 3, right column, sect. 4, lines 6-8) (e.g. It is

inherent that the synthetic signal is formed by the harmonic component and the

random component from equation 1 and 2).

However, Laroche does not specifically teach the determination of the

scaling parameter, and multiplication of the harmonic and random component.

Rao Gadde *et al.* does teach **determining a scaling parameter (see**

Figure 4, weight (W) and see col. 4, lines 15-20, SNR is used to compute the

weights) for at least the harmonic component (see Figure 4, model weight

(e.g. The model weight is used for the speech portion (see Abstract));

multiplying the harmonic component by the scaling parameter for the harmonic component to form a scaled harmonic component (see Figure 4, multiplier 430 multiplies model weight to speech model 320);

multiplying the random component by a scaling parameter for the random component to form a scaled random component (see Figure 4, multiplier 430 multiplies noise weight to the noise model 410) (e.g. The two scaling parameters or weights for the speech and noise are different, where the noise weight is 1-W and the speech weight is W);

It would have been obvious to one of ordinary skilled in the art at the time the invention was made to have modified the identification of an estimate for a noise-reduced speech signal as taught by Laroche with the use of scaling parameters for the harmonic and random component as taught by Rao Gadde *et al.* The motivation to have included these scaling parameters involves the ability to adjust the noise models based on SNR at low energy of the input signal for speech proper recognition of speech, depending on noise types (see col. 4, lines 5-21 and col. 1, lines 25-53).

However, Laroche in view of Rao Gadde *et al.* do not specifically teach determining a ratio of energy of the harmonic component without the random component of the noisy speech signal.

Gao does teach the reduction of noise relative to the noisy speech signal where the harmonic component comprises determining a ratio of energy of the harmonic component without the random component of the noisy speech signal.

(see page 2, [0025], lines 8-12) (e.g. The reduction of the background noise is done through the use of a gain factor. The signal originally contained background noise in the speech. It should be noted that the 1-NSR as shown in the formula is 1-(noise)/(signal(noise + speech). This form reduces to (noise +speech)-noise)/(noise +speech), which yields, speech/(noise + speech). This derivation shows that the harmonic component (speech) does not include random component, where in the claim the random component is interpreted as noise).

It would have been obvious to one of ordinary skilled in the art at the time the invention was made to have modified the estimation of a noise reduced speech signal presented by Laroche in view o Rao Gadde *et al.* with the reduction of noise relative to the noisy speech signal as taught by Gao. The motivation to have combined the two references involves the improvement in the quality of the voice signal (see page 2, [0021]). Further, the use of the scaling parameter as taught by Gao is another factor that can be used to weight the random and speech components instead of the use of SNR.

As to claim 2, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claim 1, above.

Furthermore, Laroche teaches modeling the harmonic component as a sum of harmonic sinusoids (see page 1, right column, sect. 1, lines 1-3 and equation 1) (e.g. It is apparent that equation 1 can be put in terms of cosine and sine using Euler's Relation. Also, the multiplication of the harmonic component

by the parameter is done through the multiplication of the individual harmonic

sinusoids. Further, the multiplication of the parameters before the summing or

after the summing is equivalent since the A_k could have been factored out and

multiplied later as a vector.)

As to claims 3 and 15, Laroche *et al.* in view of Rao Gadde in view of Gao teach

all of the limitations as in claims 1 and 13, above.

Furthermore, Laroche teaches determining a least-squares solution to

identify the harmonic component (see page 2, left column, sect. 3, 2nd

paragraph, lines 1-5) (e.g. It should be noted that a least squares method is used

to estimate the parameters to obtain the harmonic component. The voiced

segment is the harmonic component).

As to claims 5 and 20, Laroche *et al.* in view of Rao Gadde in view of Gao teach

all of the limitations as in claims 1 and 13, above.

Furthermore, Gao teaches a gain factor determined from a the ratio of the

harmonic component to the energy of the noisy speech signal (see page 2, left

column, [0025] and [0026]) (e.g. From the cited sections, a formula for the gain

factor is given. This formula is equivalent to that stated by the Applicants. NSR is

defined to be the noise energy divided by the noisy signal energy (speech and

noise) as defined in the cited sections. 1-NSR is equivalent to harmonics to noisy

signal ratio, $1-N/(S+N) = S+N-N/(S+N)=S/(S+N)$). It would have been obvious to

one of ordinary skilled in the art to sum up the energy values of the samples to get a more robust estimate for the gain for a frame of a signal or a specific window of time.

As to claims 6 and 16, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claims 1 sand 13, above.

Furthermore, Laroche teaches decomposing a vector of time samples from a frame (see page 1, right column, sect. 2, line 5-8) of the noisy speech signal into a harmonic component vector of time samples and a random component vector of time samples (e.g. The use of time samples is used as seen by the summation bounds for equation 1. Further, the random signal is obtained from the subtraction of the original speech signal by the harmonic part, which is also a specific time sample size).

As to claims 11 and 24, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claims 1 and 13, above.

Furthermore, Laroche teaches is used to perform speech recognition (see page 3, right column, sect. 6, line, 1st paragraph, line 2) (e.g. The use of speech enhancement directly relates to speech recognition). The feature vector referred to is described as being the signal representing the noise reduced signal, which is obtained from the steps stated in claim 1.

As to claim 12, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claim 1, above.

Furthermore, Laroche teaches using the noise-reduced value (e.g. also known as the synthesized signal described above) in speech coding (see page 3, right column, sect. 6, line, 1st paragraph, line 2) (e.g. It is apparent that the use of the HNM model for speech enhancement and timbre modification directly relates to speech coding since the intelligibility of the signal is of importance, which relates to the noise component).

As to claim 21, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claim 13, above.

Furthermore, Rao Gadde *et al.* teaches multiplying the harmonic component by a scaling value for the random component to form a scaled random component (see Figure 4, multiplier 430 multiplies speech weight to the noise model 320) (e.g. The two scaling parameters or weights for the speech and noise are different, where the noise weight is 1-W and the speech weight is W) is separately determined for each frame of the noisy speech signal (see col. 2, lines 61-67 and col. 4, lines 60-67) (e.g. The input signal is grouped into frames and the latter reference shows the determination of the weight.)

As to claims 23, Laroche *et al.* in view of Rao Gadde in view of Gao teach all of the limitations as in claim 13, above.

Furthermore, Rao Gadde *et al*. teaches multiplying the random component

by a scaling value for the random component to form a scaled random

component (see Figure 4, multiplier 430 multiplies noise weight to the noise

model 410) (e.g. The two scaling parameters or weights for the speech and noise

are different, where the noise weight is 1-W and the speech weight is W) is

separately determined for each frame of the noisy speech signal (see col. 2, lines

61-67 and col. 4, lines 60-67) (e.g. The input signal is grouped into frames and

the latter reference shows the determination of the weight.)

11.   Claims 7-10, 17, and 25 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Laroche *et al*. in view of Rao Gadde *et al*. in view of Gao as applied

to claims 6, 16, and 24 above, and further in view of Seltzer (CMU Speech Group

1999).

As to claims 7 and 17, Laroche *et al*. in view of Rao Gadde *et al*. in view of Gao

in view of Seltzer teach all of the limitations as in claims 6 and 16, above.

Furthermore, Seltzer does teach the determination of the Mel spectrum

from a speech signal (see page 1, sect. 2, Block Diagram).

It would have been obvious to one of ordinary skilled in the art to have

modified the harmonic plus noise model as taught by Laroche *et al*. in view of

Rao Gadde *et al*. in view of Gao by the determination of the Mel spectrum as

taught by Seltzer to find the Mel Spectrum. The motivation to combine the two

involves the extraction of features from the speech signal. The Mel spectrum

also enables the detection of voiced segments allows the frequency amplitudes

to be seen. The speech signal in this case is the synthesized harmonic

component. This method is commonly used in speech recognition systems.

As to claim 8, Laroche *et al.* in view of Rao Gadde *et al.* in view of Gao teach all

of the limitations as in claims 7 and 17, above

However, Laroche does not specifically teach the multiplication of the Mel

Spectrum for the harmonic component with the scaling factor.

Seltzer does teach the calculation of the Mel Spectrum (see Page 2, sect.

4d., see equation) by the harmonic component with the scaling factor pre-

multiplied from an input speech signal. The speech signal in this case is the

harmonic component that was modeled.

The multiplication of the scaling factor could have been pre-multiplied as

the frequency content of the signal will not change, but rather the amplitude.

However, since the scaling factor applies to all frequency components, the

scaling factor can be also multiplied after the Mel Spectrum is obtained, which

will allow the same result to be obtained. The multiplying of the scaling parameter

to the harmonics or the multiplication of the scaling parameter after the Mel

coefficients is found from the harmonics is equivalent. The scaling parameter is

the A_k value shown in claim 1. Further, the motivation to have combined the two

references was stated in the rejection for claim 7 for recognizing the synthesized

speech created from claim 1.

As to claims 9,10 and 25, Laroche *et al.* in view of Rao Gadde *et al.* in view of

Gao in view of Seltzer teach all of the limitations as in claims 6 and 16, above

Furthermore, Seltzer teaches the forming of Mel Frequency Cepstral

Coefficients feature vector (see Page 3, sect. 4e, equation) from a speech signal

for speech recognition (page 1, sect. 1, line 1). This is found from the Mel

Spectrum.

Conclusion

12.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

Hwang *et al.* (US 6,449,594) is cited to disclose model adaptation for noisy

speech recognition utilizing a pair of weights for the noise and speech component.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Paras Shah whose telephone number is (571)270-1650.

The examiner can normally be reached on MON.-THURS. 7:30a.m.-4:00p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Patrick Edouard can be reached on (571)272-7603. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

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P.S.

11/14/2007

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